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Gertsch

Gertsch Standard Signal Generator
Model SSG-1

F501

ELECTRONIC INSTRUMENTS

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GERTSCH STANDARD SIGNAL GENERATOR

MODEL SSG-1

GERTSCH PRODUCTS, INC.,

LOS ANGELES, CALIFORNIA

March 18, 1963

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SECTION I

GENERAL DESCRIPTION

The Gertsch, Model SSG-1 Standard Signal Generator is capable of generating or measuring any signal within the 10KC to 500MC frequency range, with an accuracy of 1 part in 10^7 ± LFO error (see specifications). Frequency coverage within this range is essentially continuous. (See front panel illustration).

Basic accuracy is determined by a precise, hermetically sealed, 1MC crystal. The crystal is mounted in a precision oven, which is accurately maintained at a temperature of 55° C. Crystal frequency adjustments may be made without removing the unit from the case.

The desired frequency is obtained by interpolating between accurately known crystal harmonic frequencies through the use of frequency synthesizing. This process is simplified by the employment of a X.1 and X1 multiplier section and the division of the frequency range into six bands.

A level set control enables the output level to be adjusted to 220,000uv. Provisions are also made for attenuation of the output by 130 db. Adequate shielding is provided to fully utilize this range of attenuation.

The Model SSG-1 will meet or exceed the following specifications:

Frequency Range:

Band	X. 1 Scale			X1 Scale		
1	0. 01	-	5. 0 MC			
2	5	-	8 MC	50	-	80 MC
3	8	-	13 MC	80	-	130 MC
4	13	-	21 MC	130	-	210 MC
5	20	-	32 MC	200	-	320 MC
6	31	-	50 MC	310	-	500 MC

Frequency Accuracy

10 KC - 50 MC

± 1 part 10^{-7} ± 1 cps

50 MC - 500 MC

± 1 part 10^{-7} ± 10 cps

RF Output:

Uncalibrated - 500, 000 uv Min.

Calibrated - 220, 000 uv Max. (0 dbm)

Attenuation Range:

+7 to -130 db

Attenuator Accuracy:

± 1 db to 20 db

± (1 db + 1%) 20 - 100 db

± 2 db above 100 db

Resolution:

1 cps steps (10 KC - 50 MC)

10 cps steps (50 MC - 500 MC)

AM Modulation:

1. Internal - 400 cps and 1000 cps fixed
2. External - 100 cps to 10 KC
3. Adjustable to 50%
4. Envelope Distortion - 10% Max.

Output Impedance:

50 ohms

Power Requirements

115/230 VAC, 50 - 400 cps

SECTION II

THEORY OF OPERATION

The standard from which all harmonics are derived is a 1 MC crystal oscillator. High accuracy and stability is thus provided throughout the frequency range.

As shown by the block diagram, harmonics of the 1 MC are compared with the harmonic oscillator output in the phase detector. When the oscillator frequency is a multiple of 1 MC, a DC output is produced in the phase detector which is used to control a reactance device in the oscillator tuned circuit. This loop phase locks the oscillator in 1 MC steps with the accuracy of the crystal. The other phase lock loops which are derived with the accuracy of the crystal work in a similar fashion except they are at different frequencies. They are locked in steps of 100 KC, 10 KC, 1 KC and 100 cycles.

The harmonic oscillator output is mixed with the output of the HFO. This produces a difference frequency in the 4 - 3 MC IF. In the example the frequency is 3.654322 MC. When the 1 MC decade switch is rotated for maximum reading on the Fine Tune meter this difference frequency can be determined within 100 KC.

The output of the 4 - 3 MC IF is mixed with the output from the harmonic oscillator which locks in steps of 100 KC. This produces a difference frequency in the 300 - 400 KC IF. In the example the frequency is 345.678 KC. When the 100 KC decade switch is rotated for maximum reading on the Fine Tune meter this difference frequency can be determined within 10 KC.

The output of the 300 - 400 KC IF is mixed with the output from the harmonic oscillator which locks in steps of 10 KC. This produces a difference frequency in the 40 - 50 KC IF. In the example the frequency is 45.678 KC.

The above frequency is compared with a frequency from the 40 - 50 KC oscillator in a phase detector. The output of the phase detector is a DC signal which varies the reactance in the tuned circuit of the HFO. In this manner the HFO output is locked back to the crystal which insures both accuracy and stability.

The 40 - 50 KC oscillator is phase locked by synthesizing techniques in a similar fashion to that used to phase lock the HFO.

The HFO buffer is tracking to the same frequency as the HFO. When the multiplier switch is in the .1 position the output is directed to the output jack. When the multiplier switch is in the X1 position the output is directed to the harmonic generator.

The harmonic generator will amplify the input signal so that harmonics are easily created for the input to the X5 multiplier.

The X5 multiplier amplifier is tuned to a frequency which is 5X the input frequency. Its output acts as the input to the X2 multiplier. The X2 multiplier is tuned to a frequency which is 2X its input frequency. Therefore the output frequency is ten times that of the input to the 5 to 50 MC harmonic generator.

The multiplier buffer is used to isolate the X2 multiplier from the generator output.

The 10 KC to 5 MC signal is formed by an input to the mixer of between 15 - 20 MC from the HFO buffer and the 15 MC harmonic oscillator. The harmonic oscillator is phase locked to the 1 MC oscillator in a manner previously described.

The modulator and VTVM provide outputs respectively to the level set and modulation meters. An automatic AGC signal is also created here which

will keep the output signal constant with changes in frequency.

The beat detector is used when measuring an unknown frequency by producing the difference frequency. This is inserted into the audio amplifier for both aural and visual display.

The audio amplifier will also take an external audio signal created in any external beat detector for both visual and aural display.

The attenuator is continuously variable between 0 and 130 dbm and is connected to the RF output.

The modulation amplifier is used to modulate both the HFO buffer and multiplier buffer depending upon which position the multiplier switch is in. Its input can be from an external source or from the internal modulation oscillator. The modulation oscillator operates at either 400 or 1000 cps.

SECTION III

OPERATION

GENERATING A FREQUENCY

To generate a frequency of 123.456780 MC the following procedure is followed:

1. Set BAND switch to correct band.
2. Set MODE switch to FINE TUNE 2 position.
3. Set the multiplier switch in the X1 position.
4. Set the HFO tuning dial on 12 and until MC lamp lights.
5. Set all the decade switches to their respective positions of desired frequency.
6. Adjust the FINE TUNE control to provide a maximum output on the TUNE to MAX meter.
7. Set MODE switch to LOCK position. The output frequency will now be locked back to the basic crystal frequency accuracy with the exception of LFO error which is less than ± 1 cps.

MEASURING A FREQUENCY

To measure an unknown frequency of 123.456780 MC use the following procedure.

1. Set BAND switch to correct band.
2. Set MODE switch to SEARCH position.
3. Insert unknown frequency into front panel EXT RF INPUT jack.
4. Turn HFO tuning control until a zero beat is heard on headphones.
5. Re-set HFO for the next lowest MC point until the MC lamp lights.
6. Set MODE switch to FINE TUNE 1 position.
7. Adjust FINE TUNE control for zero beat on headphones.
8. Set MC decade switch for maximum output on TUNE to MAX meter.

9. Set MODE switch to FINE TUNE 2 position.

10. Set 100 KC decade switch for maximum output on TUNE to MAX meter.

11. Set MODE SWITCH to LOCK position.

12. Set 10 KC decade switch for minimum frequency beat note.

13. Set 1 KC decade switch for minimum frequency beat note.

14. Set 0.1 KC decade switch for minimum frequency beat note.

15. Set 0.01 KC decade switch for minimum frequency beat note.

DO NOT SCALE DRAWING

REVISIONS				
ZONE	SYM.	DESCRIPTION	DATE	APPR.

SPECIFICATIONS

Frequency Range:

Band	X.1 Scale			Xl Scale		
1	0.01	-	5.0 MC			
2	5	-	8 MC	50	-	80 MC
3	8	-	13 MC	80	-	130 MC
4	13	-	21 MC	130	-	210 MC
5	20	-	32 MC	200	-	320 MC
6	31	-	50 MC	310	-	500 MC

Frequency Accuracy:
10 KC - 50 MC
± 1 part 10^{-7} ± 1 cps
50 MC - 500 MC
± 1 part 10^{-7} ± 10 cps
Spurious FM: Less than .0001%
RF Output:
Uncalibrated - 500,000 uv min.
Calibrated - 0 dbm
Attenuation Range:
0 to -130 db (calibrated) continuously variable
0 to +7 db (uncalibrated)
Attenuator Accuracy:
± 1 db to 20 db
± (1 db + 1% of reading) 20 to 100 db
± 2 db above 100 db
AM Modulation:
1. Internal - 400 cps and 1000 cps.
2. External - 100 cps to 10 KC
3. Adjustable to 50%
4. Envelope Distortion - 10% max.

Output Impedance:
50 ohms
Power Requirements:
115/230 VAC, 50 - 400 cps
100 volt-amperes (approx)
Size (max):
15" wide x 18" high x 20" deep including protective front cover.

SC-317

FEATURES

1. Can be used for measuring frequencies from 10 KC to 10 GC with external multiplier-mixer assembly. (10 KC to 1 GC without accessory equipment.)
2. Automatic level control to keep RF output level constant with frequency change.
3. In-line direct digital readout.
4. Synthesizing circuitry may be driven from internal or ext. 1 MC standard.
5. Solid State Design.

REQ.	DWG. SIZE	PART NUMBER	DESCRIPTION	ITEM NO.

LIST OF MATERIALS

DASH NO.	MODEL NO.	NO. REQ.	NEXT ASSY.	NO. REQ.

REMOVE ALL BURRS AND BREAK EDGES .010 MAX.	SCALE FULL	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES: DECIMALS ± FRACTIONS ±	MATERIAL / FINISH
DRAWN	12-10-67		
CHECK			
MECH. ENG.		TITLE: FRONT PANEL LAYOUT	NO. SC-317 REV.
ELEC. ENG.			SHEET ___ OF ___
APPR.			

Gertsch
GERTSCH PRODUCTS INC.
LOS ANGELES, CALIF.
CODE IDENT NO. 88869

DO NOT SCALE DRAWING

REVISIONS				
ZONE	SYM.	DESCRIPTION	DATE	APPR.

1 — 100 MC
2 — 10 MC
3 — 1 MC
4 — 100 KC
5 — 10 KC
6 — 1 KC
7 — 0.1 KC
8 — .01 KC

1 MC XTAL OSC.
EXT 1MC IN
INT / EXT
1 MC SHAPER
PHASE DET.
HARMONIC OSC. 9-53 MC (16 MC)
FINE TUNE
H.F. OSC 5-50 MC (12.345678 MC)
H.F.O. BUFFER 5-50 MC (12.345678 MC)
HARMONIC GEN. 5-50 MC
MULT. X5 25-250 MC (61.728390 MC)
MULT. X2 50-500 MC (123.45678 MC)
MULT. BUFFER 50-500 MC (123.45678 MC)
HFO TUNE
BAND SWITCH
X 0.1 COAX (K2)
LOCK
100 KC DIVIDER & SHAPER
HARMONIC OSC. 4.3-3.4 MC (4.0 MC)
MIXER & 4-3 MC I.F. (3.654322 MC)
SEARCH
FINE TUNE
MOD. AMP.
MOD OSC.
EXT MOD. IN
10 KC DIVIDER & SHAPER
HARMONIC OSC. 260-350 KC (300 KC)
MIXER & 300-400 KC I.F. (345.678 KC)
MIXER & 40-50 KC I.F. (45.678 KC)
OSC. 40-50 KC (45.678 KC)
1 KC DIVIDER & SHAPER
HARMONIC OSC. 36-45 KC (41 KC)
100 N DIVIDER & SHAPER
HARMONIC OSC. 3.5-4.4 KC (4.1 KC)
MIXER & 4-5 KC I.F. (4.678 KC)
500 N BUFFER & SHAPER
MIXER & 500-600 N I.F. (578 N)
STEPS / CONT. RESOLUTION
L.F.O. 500-600 N (578 N)
PHASE DET.
VTVM
DEMOD.
MOD. SET
LEVEL SET
S-50
0-5
0-5 (K1)
0-5 (K4)
0-5 MC AMP
FILTER
(15-80 MC)
MIXER
VISUAL
AURAL
K-9 COAX
MEAS. GEN.
AUDIO AMP
BEAT DET.
ATTENUATOR
HARMONIC OSC. 15 MC
MC SHAPER
AUDIO - EXT. INPUT - RF
RF OUT
1 MC IN

READ OUT -STEPS- (NIXIES)

HFO TUNING MC-OUT

BAND	X.1 SCALE	X 1 SCALE
1	0.1-5	
2	5-8	50-80
3	8-13	80-130
4	13-21	130-210
5	20-32	200-320
6	31-50	310-500

* FREQ. CONTAINED IN BLOCKS USED TO OBTAIN OUTPUT FREQ. SHOWN ON NIXIES

REV.

REQ.	DWG. SIZE	PART NUMBER	DESCRIPTION	ITEM NO.

LIST OF MATERIALS

REMOVE ALL BURRS AND BREAK EDGES .010 MAX.
SCALE
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES: DECIMALS ± FRACTIONS ±
MATERIAL
FINISH
DRAWN
CHECK
MECH. ENG.
ELEC. ENG.
APPR.
TITLE
NO.
REV.
SHEET ____ OF ____

Gertsch
GERTSCH PRODUCTS INC.
LOS ANGELES, CALIF.
CODE IDENT NO. 88869

DASH NO.	MODEL NO.	NO. REQ.	NEXT ASS'Y.	NO. REQ.